



Shared Information and Virtual Surfaces

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Objective

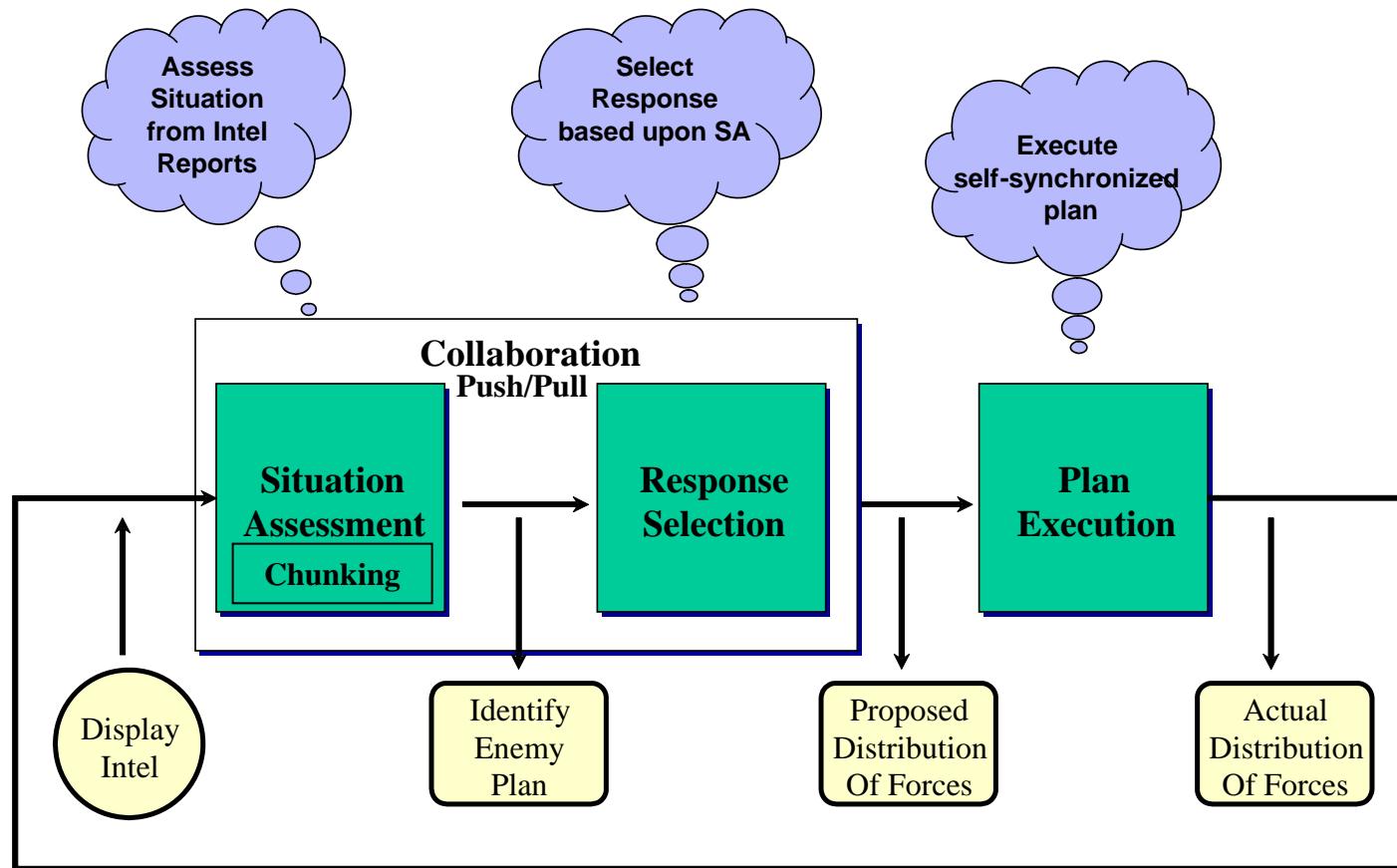
- Investigate performance of self-synchronizing teams
- Understand how teams collaborate in situations characterized by high stakes, time pressure and uncertainty

Research Vision

Problem: teams have difficulty coordinating their actions in real-time

Question: how can we support teams operating in rapidly changing environments?

Research Model



Empirical investigation of our model of
Team Recognition Primed Decision Making



Team Compensatory Aids

- Perception Tools for
 - *Pattern Recognition*
 - *Sharing of Intention*
- Attention Tools for
 - *Gesturing*
 - Alerting (negotiated)
 - Awareness
- Memory Aids for
 - Mitigating the Effects of Stress

Research Measures

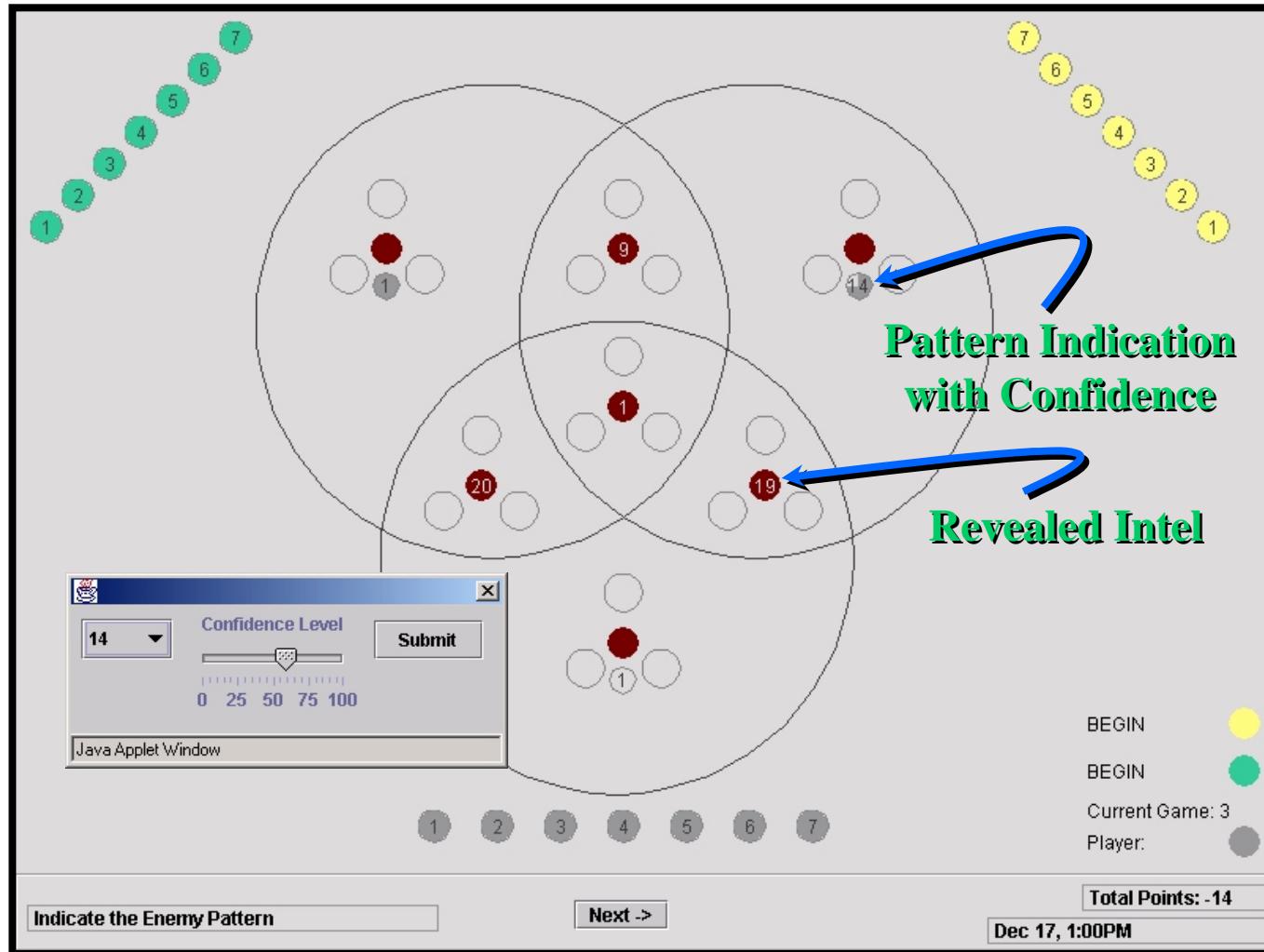
- Outcome Measures: *Quality, Speed*
- Process Measures:
 - *Pattern Recognition, Confidence*
 - *Information Sharing, Intention*
 - *Collaboration*
 - *Leadership*
- Mental Models: *Pathfinder C*



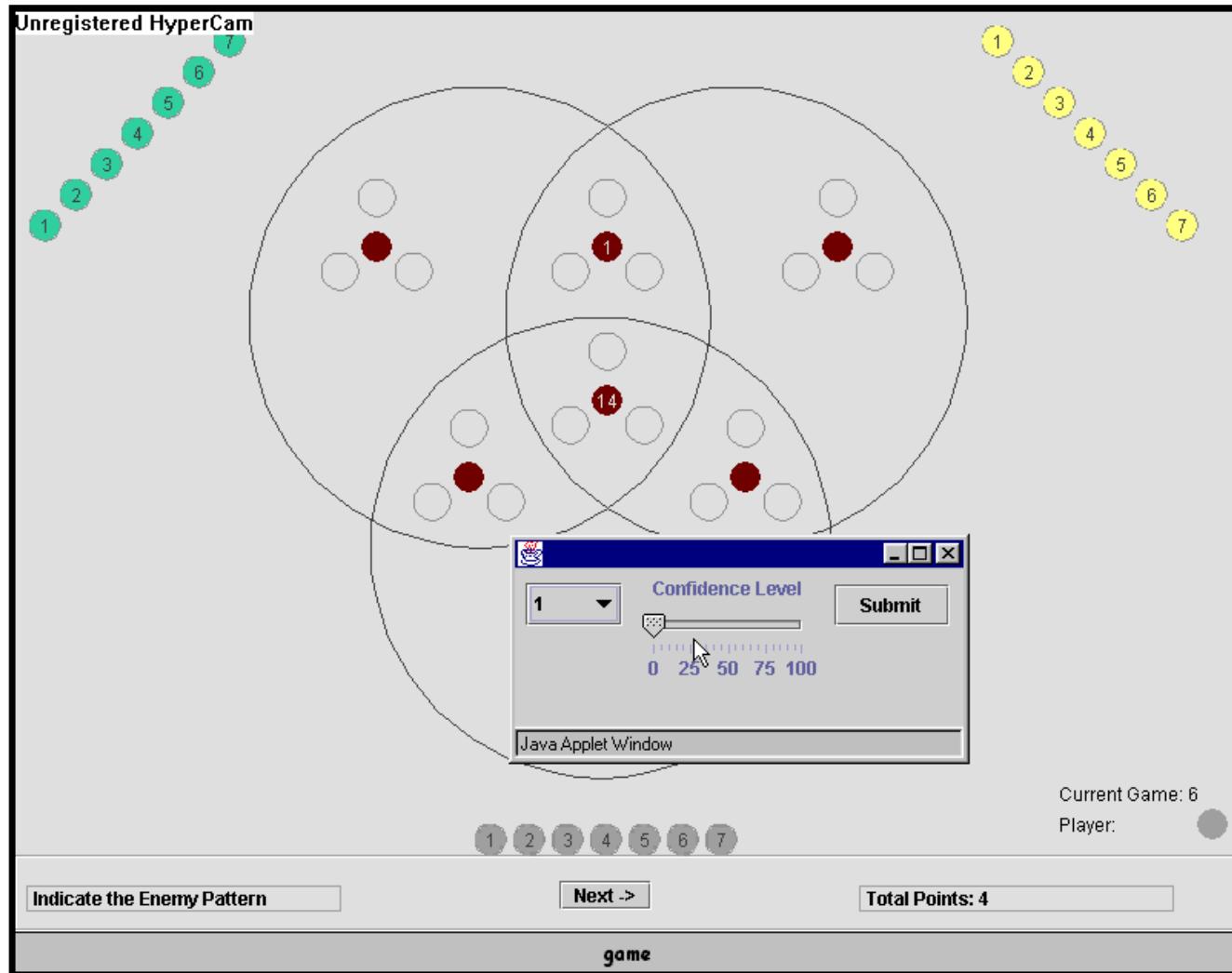
Decision Game

- Cooperative 3-Player Game
- 7 Tokens, numbered 1-7
- Opponent has asymmetric force
 - Patterns: Definitive, Equivocal, Uncertain
- Team places tokens so total \geq opponent
- Play is interactive

Game Screen



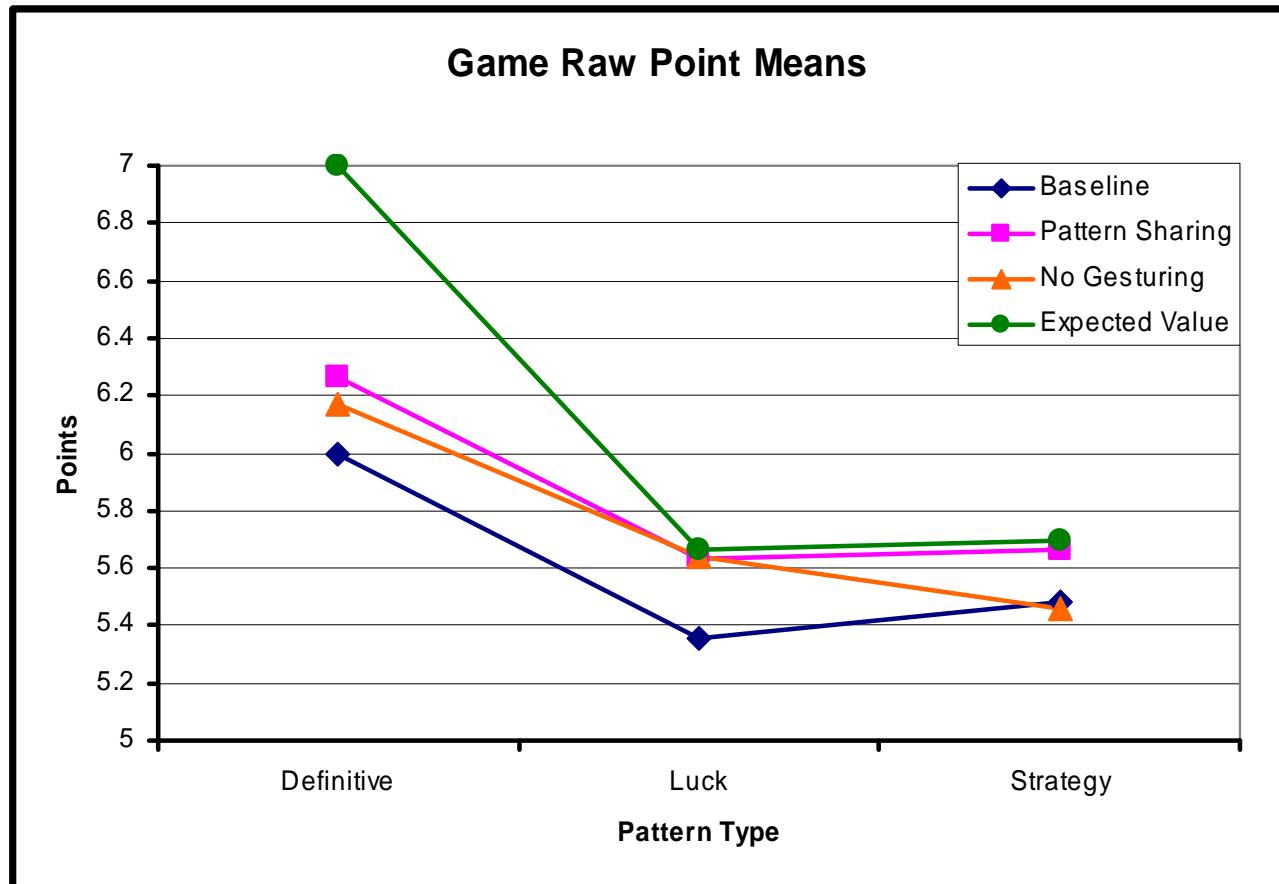
Video



Current Progress

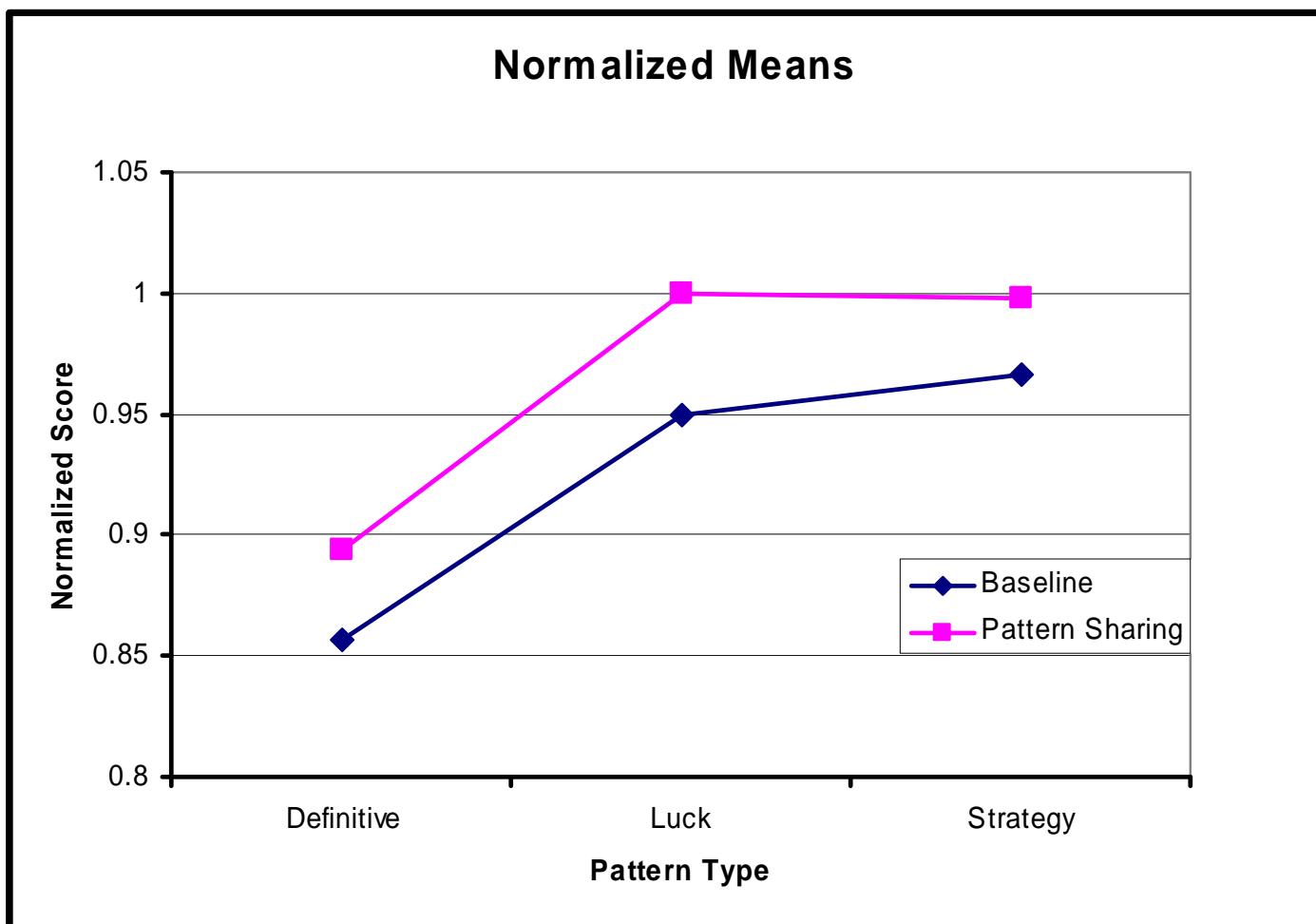
- Model and Software Developed
- Data Collected:
 - 144 Participants, 3 Treatments
- Analysis Performed
- Findings Reported

Raw Scores



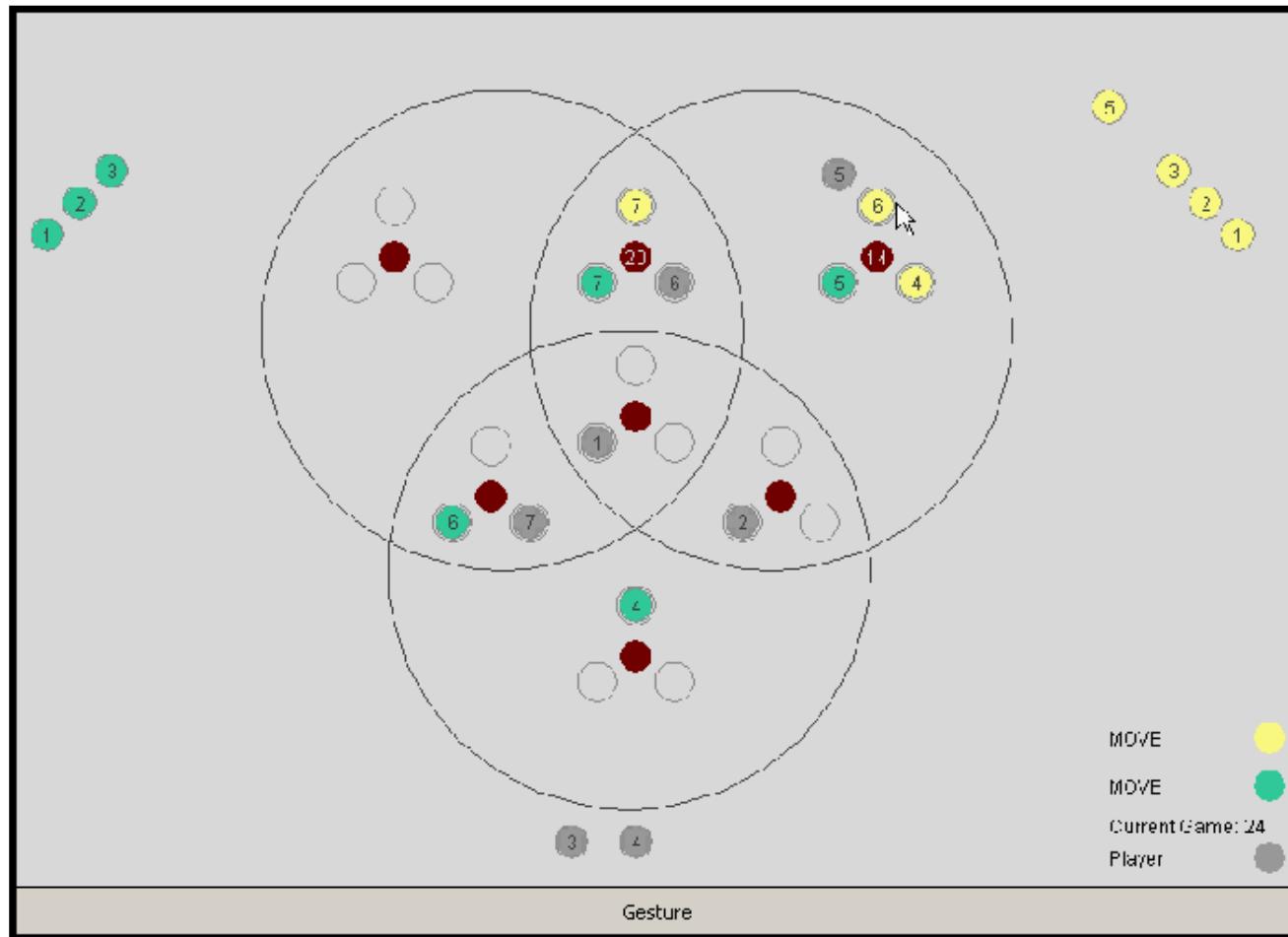


Normalized Scores





Gesturing Example



Conclusions

- Team Recognition Primed Decision Making Model Validated
 - More time spent in situation assessment than in response selection
 - Pattern sharing reduces “extra” movement by 50%
 - Surprise finding wrt importance of real-time gesturing

Research Issues

- Shared Mental Models
 - Similar or compatible knowledge
Cannon-Bowers, J. E. & Salas, E. (2001)
“Reflections on Shared Cognition”, *Journal of Organizational Behavior*, 22(March):195-202
 - Consensus on who knows what
Kraut, R. E., Lerch, F. J., & Fussell, S. R. *The Development of Shared Mental Models and Group Performance* ([NSF IIS-9812123](#))

Research Issues

- Team Cognitive Chunks
 - Slots and Templates
Gobet, F. & Simon, H. A. (in press)
“Five Seconds or Sixty? Presentation Time in Expert Memory”, Cognitive Science.
 - Labels and Mnemonics
Staszewski, J. (1990). Exceptional memory: The influence of practice and knowledge on the development of elaborative encoding strategies. In F. E. Weinert & W. Schneider (Eds.), *Interactions among aptitudes, strategies, and knowledge in cognitive performance*, (pp. 252-285). New York: Springer.

Research Issues

- Attention Management

- Negotiated Alerts

Horvitz, E., Jacobs, A., & Hovel, D. (1999) “Attention-Sensitive Alerting”, In Proceedings of UAI '99, Conference on Uncertainty and Artificial Intelligence (pp. 305-313).

McFarlane, D. C. (1999) “Coordinating the Interruption of People in Human-Computer Interaction, Human-Computer Interaction”, INTERACT'99, Sasse, M. A. & Johnson, C. (Editors)

- Information Push and Pull

Cybenko, G. and Brewington, B. “The Foundations of Information Push and Pull,” in The Mathematics of Information Coding, Extraction, and Distribution (G. Cybenko, D.P. O'Leary and J. Rissanen editors), Springer, IMA Volume 107, 1999.

Research Issues

- Team Memory
 - Targets and Distractors

Clark, S., Hori, A., Putnam, A., and Martin, P. (2000) “*Group Collaboration in Recognition Memory*”, Journal of Experimental Psychology: Learning, Memory, and Cognition, 26(6):1578-1588.

Research Issues

- What You See Is What I See (WYSIWIS)
 - Strict and Relaxed
Stefik, M., Foster, G., Bobrow, D.G., Kahn, K., Lanning, S., and Suchman, L. (1987) “*Beyond the chalkboard: Computer support for collaboration and problem solving in meetings*”, Communications of the ACM, 30(1):32-47.
 - Mutual Orientations
Valin, S., Francu, A., Trefftz, H., Marsic, I. (2001). “*Sharing Viewpoints in Collaborative Virtual Environments*,” In Proceedings of Hawaii International Conference on System Sciences, 3, 1-9.

Research Issues

- Information

- Common vs. Private

Stasser, G., Vaughan, S., and Stewart, D., (2000).

“Pooling Unshared Information: The Benefits of Knowing How Access to Information Is Distributed Among Group Members,”

Organization Behavior and Human Decision Processes, 82(1):102-116.

Research Issues

- Eye Tracking
 - Pupil Dilation and Cognitive Load

Marshall, S. P., Morrison, J. G., Allred, L. E., Gillikin, S., & McAllister, J. A. (1997).
“Eye tracking in tactical decision-making environments: Implementation and analysis”, in Proceedings of the 1997 Command and Control Research and Technology Symposium (pp. 347-355).



FY '02 Research Plan

- Explore sharing of pattern chunks
 - Labels
 - Mnemonics
 - Templates (slots)
- Rewards for speed and accuracy